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SOME OBLIGATIONS AND OPPORTUNITIES OF SCIENTISTS IN THE UPBUILDING OF PEACE[1]

We have been free from the turmoil of actual warfare for something over a year and it is high time we turn our faces with resolute courage toward the coming years with the determination that the world shall be a happier, saner, and safer one for humanity. The results of victory have probably not been all that we expected and certainly not all that many of us desired while in many respects the results have been entirely unforeseen. To scientists, I imagine, one of the most surprising outcomes of the war has been the sudden and I believe permanent enthronement of science in the activities of humanity. In the carrying on and the winning of the war, men of science played an unexpectedly important and indispensable part. The roll of honor among the sciences is large and includes certainly all of them represented here to-night. The men in these sciences were called from every quarter of the nation; and the promptness with which they answered the calls and the effectiveness with which they met the demands made upon them should be a source of pride and profound satisfaction to every one of us.

THE STANDING OF SCIENCE IN THE MINDS OF THE PEOPLE

As a result of their work the value of research and investigation to the welfare of the nation, whether in peace or in war, has taken hold on the minds of the people as never before; and the worth and usefulness of the scientist to humanity have received general recognition from the public to an extent long justified but hardly expected in our day and

[1] An address delivered at the installation of the new members of the Alpha Chapter of Sigma Xi at Cornell University, May 18, 1920.

age. As one clear evidence of this I cite the adoption, by the American Federation of Labor at Atlantic City, of that noteworthy resolution with its remarkable preambles concerning the importance to the nation of scientific research. The resolution is well worth repeating here and is as follows:

Resolved, by the American Federation of Labor in convention assembled, that a broad program of scientific and technical research is of major importance to the national welfare and should be fostered in every way by the federal government, and that the activities of the government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the secretary of this federation is instructed to transmit copies of this resolution to the President of the United States, to the president pro tempore of the Senate, and to the speaker of the House of Representatives.

The five preambles preceding the resolution set forth in a very clear, cogent manner the importance of research to the development of our industries, manufacturing, agriculture, mining, to increased production, and to the general welfare of the workers. One can not fail to realize that the accumulated achievements of science prior to the war together with the accomplishments of scientists during that terrible struggle have created a heritage for future generations of research workers from which they may "take increased devotion" to their chosen pursuit. Although we may feel gratified with this background of the status of research and with the present position of science we must not forget that there is another and serious side to this situation. We must not forget that this world confidence in our work and reliance upon us for future accomplishment put upon us an enormous responsibility and a high obligation to show ourselves worthy of the faith and equal to the expectations of humanity. Moreover, we are now in a position where we must make a determined effort to meet these added obligations and live up to them in the same devoted, courageous, unselfish spirit of achievement with which this heritage has come to us and we must carry them on with energy, effectiveness, and joy. What, then, are some of the obligations and opportunities of the scientist in the coming years of peace?

OPPORTUNITIES OF SCIENTISTS IN THE SOCIAL WELFARE OF THE PEOPLE

First of all it seems to me that the student of science will necessarily take a more active part in certain directions, at least, in attempts to aid in solving some of the social and perhaps political problems of the people. Indeed it appears to be his duty to do so and the opportunity is worthy of the man. As a case in point with which I have been much impressed was the partitioning of Austria-Hungary by the Conference of Paris. Simonds points out very forcefully that in this partitioning there was created one state rich in minerals and possessing considerable industrial machinery but having no areas of soil on which food can be grown for the support of its people. Another state was created containing the city of Vienna which apparently has no sources of food, of raw materials, or of any of the elements necessary for self-maintenance, while a third state was set apart that has no minerals and few raw materials but can produce more food than is needed for its own consumption yet it was given no outlet to the sea and was left with no means of transportation by which products can be exchanged between it and adjacent states. Thus the economic situation created by academic statesmen and politicians is an impossible one. If the technically trained civil-engineer, mining engineer, geologist, soil technologist, and agronomist, for example, had been sent to study the regions and their data had been laid before the Conference and the vital bearing of their findings on the economics of the situation had been pointed out, perhaps, as Simonds says, from another point of view, the eggs would not now have to be wholly unscrambled in order to make living conditions for those middle European people possible. Certainly the opportunity for the scientist in this political matter was and is

yet, I believe, perfectly evident and the world should be made to understand it.

Another field in which the scientist must take a more active part in certain social problems of the people is the direct outcome of a state of affairs which his own efforts have produced. I refer to the results of research in the industrial world and the effect on the social condition of the worker.

The researches of science in the industrial world and the enormous development of specialized machinery and processes of manufacture have resulted in producing great inequalities in the social life of the people. These researches have certainly resulted in giving power to a few men and in belittling the position and character of many men, notably, the individual workers. The technical results of industrial research have made possible the practical control of the world's production of clothing, furniture, much of its food, and means of transportation by a comparatively few men. Industrial research and development have made some men very rich and caused a great many men to remain uncomfortably poor. I do not mean to say that the laborer is not better off to-day in houses, supplies of food, clothing, entertainment, and the general comforts of life than he has ever been in the history of the world, but I do say that he is tending to become more of an automaton, more of a machine, and less of an individual and that he is still living largely under sanitary and health conditions that are wholly incompatible with the advancement of the age and our present knowledge. These effects on the worker and on society are some of the paradoxes of industrial scientific research and investigation. And it appears as though further activities of this line of research will tend still farther in the same direction, yet the need for similar and more intense investigation, as I shall try to point out, is absolutely imperative and more pressing than ever before.

Unquestionably the major problems of social welfare must be left to the student of humanities who is especially equipped by his knowledge of the philosophies, religions, languages, racial temperaments, and histories of man, to deal with these questions. Yet I believe the scientist may do much to alleviate the effects of his industrial researches and, it seems to me, he has an obligation in this matter to meet and a duty to perform which perhaps have not been fully realized. The laboring men, in one of the preambles to the resolution which I have read, have already indicated the direction in which a part of the effort of the scientist must go in this matter. In speaking of the importance of scientific research the laboring men said "and the health and well-being not only of the workers but of the whole population as well are dependent upon advances in medicine and sanitation." In this direction, then, may lie some of the efforts of the scientist to ameliorate the unsatisfactory conditions brought about by industrial research. Certainly any improvement in the sanitary and health conditions of the laboring man will react upon his social welfare. Here the medical man, the sanitary engineer, and the biologist may find an enlarged opportunity and a chance to aid in undoing, as it were, some of the undesirable results that the scientist has unwittingly brought about in his zealous investigations. Indeed, in a wider way, anything that the scientist can do to vary the monotony of the laborer's job, to remove the danger of accident to life and limb, to relieve the abnormal strain of fatigue, or to improve the man's well-being in any way should be done and unquestionably the scientist has a duty in this direction to perform.

SOME PROBLEMS AWAITING SOLUTION BY SCIENTISTS

But aside from these questions which many of us will deem relatively unimportant there yet remain out of the many momentous problems facing the world to-day at least three which are pressing for immediate solution and a fourth one which needs new emphasis and added stress.

The problems to which I refer are: (1) the serious need for an increase in the production of the necessities of life; (2) the development

in the shortest possible time of more extensive and more efficient means of transportation; (3) the increase of the sources of physical power and force; and (4) the maintenance and increase of the ideals and the spiritual forces of humanity.

In considering the first three of these problems one can not escape the conclusion that the scientist should and inevitably will be one of the chief agents upon whom the world must rely for aid in the solution of them.

THE PROBLEM OF INCREASING PRODUCTION

The world to-day is facing a serious shortage of food supplies, which, in some European countries, has already reached the acute stage of famine conditions. In the United States the farmers are facing a labor shortage which in many cases is actually curtailing production, while some, having arrived at an advanced age at which their physical stamina is not strong enough to withstand the discouraging situation, are not only disposing of their farms but are actually abandoning them and adding themselves to the already great army of unproductive people in the towns and cities.

In this situation the trite and familiar saying that "he who makes two blades of grass grow where one grew before" takes on a new meaning—a meaning not only of fame and altruism but of dire necessity to the human race. The chemist and the soil technologist must show how the farmer can produce more per acre; the engineer must devise machinery for the production of crops on an increased acreage with lessened labor; the physicist, chemist, and electrical engineer must show us how to get more and cheaper supplies of nitrogen; the plant breeder must develop more productive varieties of plants; and the zoologist and botanist must find better methods of protecting the crops produced from destruction.

It is not, however, in food alone that we are suffering from an underproduction. It is the same story in clothing, household furnishings, building materials, farm machinery, and other vital supplies; and in the face of it all the laboring element is struggling for shorter hours of labor and certainly in general a consequent lessened productive capacity per man. The laboring man of America appears blind to the fact that his higher wages, greater comfort, and general prosperity over that of his European contemporary have been due primarily to his greatly increased productive capacity under the conditions of industry as carried on in this country. And his utter fatuity in attempting to curtail the very thing that contributes to his well-being is one of the amazing things in the world to-day. In spite of this paradoxical attitude the laboring man is struggling for more leisure and seems destined to attain it.

THE PROBLEM OF INCREASING THE MEANS OF TRANSPORTATION

Turning for a minute to our second problem, the necessity of better and more economical means of transportation, let us recall briefly the conditions as they exist to-day. Competent authorities estimate that the country's transportation needs in the last six years have increased 45 per cent. while the railroad facilities have increased but 2 per cent. We are told that from 300,000 to 800, 000 new freight cars and from 1,000 to 2,000 additional engines are needed at once while Europe is infinitely worse off than we are. It appears that some cities in southern Europe actually faced famine conditions for a time, at least, with supplies within reasonable distance but absolutely unavailable because no means of transportation existed to bring them within reach of the suffering community.

The transportation problem in this country has been developed by men whose principle aim in former years, at least, has been to make the railroads pay attractive dividends on the stock which has often been watered stock. The time has come, it seems to me, when the whole matter should be put on a thoroughly scientific basis by the technically, scientifically trained man. The permanent cure for many of the ills of transportation is to determine by careful scientific research and investigation more efficient and cheaper

types of power, fuel, engines, cars, and other equipment that enter into the problem. In other words, the costs of the means of transportation should be lessened rather than the price to the public increased. The answers to these questions will be obtained very largely by the investigator.

Intimately bound up with this whole question is that of public highways and their function as means of transportation. The motor truck or some similar and, I hope, more efficient vehicle, seems destined to revolutionize the methods of the interchange of products, certainly within the confines of reasonably limited areas. But in this matter, as in scores of others affecting intimately the welfare of mankind in this country, we have pursued a policy of *laissez faire*. We have bonded the state, taxed the people, built the roads, watched them crumble to dust and have then bethought ourselves of the desirability of an investigation of the principles of road making and of road materials. Unquestionably we shall awake in time to the necessity of a careful, thorough, extended investigation of the whole question of transportation. When that time comes the country will inevitably turn to the scientist for aid in solving the problem. The opportunity is inviting and I trust we shall have men trained for the work.

THE PROBLEM OF INCREASING THE SOURCES OF PHYSICAL POWER

The third problem to which I referred, namely, that of the need of increased or entirely new sources of physical force or power is a larger and really more basic question. The railroads of this country in 1918 used approximately 165,000,000 tons of coal. What the marine and stationary engines used during that year I do not know but the aggregate must have been large. From all of this vast amount of coal consumed in the United States for the purpose of generating force, approximately 90 per cent. of its heat was never delivered as mechanical power by the engines in whose boilers it was burned. What an overwhelming waste? And simply because of our present inability to avail ourselves of anything like the total inherent force or power that lies within this costly, steadily decreasing product, coal. In what dire need the world is of this latent but lost power! How much labor, energy, money, cargo-space, ships, and cars now used in mining and transporting coal could be devoted to other lines of industry and commerce if only one half of the latent power of this mineral could become available and that is the task that confronts the scientist. The last word on the means of utilization of this vast waste of power has certainly not been said.

Oil, our other great natural commodity from which we obtain physical power is already in greater demand than it can be supplied from our own fields. The situation is already acute and in less than a score of years the supply in the United States promises to be exhausted. Either new sources of oil must be found or some substitute must be produced.

Electricity, another of our great forces is now awkwardly obtained by expensively harnessing some mighty stream or by wasting nearly all of the latent power of coal to capture, as it were, this omnipresent, illimitable agency of force. There ought logically to be some method by which we could avail ourselves of this force in a more direct way—by reaching out, as it were, and taking it.

At the best then our present sources of physical power are very inadequately available or are hopelessly declining. In either event something must be done and done in the immediate future or we shall revert to semi-primitive conditions. It is to the scientist that we must look in large measure for the solution of this vital question.

In considering then, these three problems one can not fail to be impressed with the seriousness of the situation. In confirmation allow me to relate briefly a recent experience. Within the last week I received a letter from a company in New York City saying, "we can not make shipment of your material from New Jersey but we think we may be able to

send it from our stock here in the city if you are willing to pay the extra cartage." On the self-same day I received a notice from a company in Chicago saying, "the express companies are unable to handle express from Chicago to points in New York State." The next day the same company sent me notice that although they were preparing the order for shipment by freight the railroads in Chicago could not accept it at present and they feared there would be considerable delay in forwarding the order. These happen to be coincidents, indicative not only of the present condition of transportation but of much deeper and more serious social and political conditions. It is amazing and rather startling to awake and find that in this country of ours there is to-day but one agent of transportation actually and fully functioning—namely the United States Parcels Post. Unquestionably these conditions are partly due to the abnormal unrest in the minds of the people but what is much more serious, out of these conditions is bound to come further unrest, so that the end is not now in sight. In spite of one's faith in this beloved country of ours and in spite of one's boldest optimism one can not look forward without some fear and misgiving and our hope must rest very largely in the ability and the genius of our young men and women, especially in those who are trained to think and to work independently with the methods of research. If scientists can solve the problems we have touched upon they will not only contribute to the material welfare of the country but will also aid in allaying and finally settling the social unrest of the people. The obligations of the scientist in the upbuilding of peace are great and opportunity is knocking at the door of each one of us.

THE CONTINUED NEED FOR RESEARCH IN PURE SCIENCE

The discussion, so far, has turned mainly on what the world has long called, applied research. It seems to me that the term applied research is a misnomer and that it would be far more accurate and nearer the truth to designate it as research, applied. That is to say, in the solution of any problem by scientific investigation, no matter in what direction it may eventually tend, there must first be research, pure and intensive, accurate and often prolonged, followed if you please by an application of the principles so discovered. Thus we have had and must have in greater measure in the future, as I have already tried to point out, research, the resultant principles of which may be applied to the solution of economic problems affecting the public welfare. On the other hand, there is among men such a thing as research for the pure love of it. The characteristics, however, of such research do not lie in the method of work but rather in the spirit of the man doing it. The intensity of the work, the broadness of it, and the accuracy of it, do not differ one whit from the research work that may come to have an economic application. The differences between the two are psychological—attributes of the man. One investigator is absorbed in the beauty and sublimity of truth and in its discovery without any thought of aiding humanity while the other carries on his research with the hope that he may not only discover truth but that it may be of practical benefit to the human race. But these subtle distinctions if they really exist are of no consequence. What I wish to emphasize is, that work in pure science constitutes after all the most fundamental kind of research for humanity because it touches the spirit and the soul of mankind and everlastingly ennobles the human race. Pure research in science or in the humanities has been and still is the basis for all intellectual and moral progress and advance in enlightenment among all races and all peoples. And at this critical stage of civilization the spiritual force of this kind of intellectual activity needs new emphasis and added stress. The spirit of the pure scientist is the spirit that we desire to see pervade all humanity and all of the activities of humanity. It is a spirit of truth and honesty that tends to banish superstition, narrowness, greed, selfishness, and provincialism and to establish char-

ity, fairness, justice, and democracy. Indeed all high intellectual effort, whether in science or in the humanities, embodies this spirit. I can think of no happier illustration of this fact than the reply of the celebrated American artist, Edwin A. Abbey, when he was asked why he was so particular about the historical exactness of every detail, being assured that he was the only one who would know the difference. He replied by quoting the following verse:

> In the elder days of art,
> Builders wrought with greatest care,
> Each minute and unseen part;
> For the gods see everywhere.

He said:

> It is because I can't forget those lines that I must make things as right as I know how, even if nobody is the wiser. "The gods see everywhere."

It is this spirit of honesty with one's self for the sake of honesty and truth that pervades all genuine intellectual effort, whether in science or in the humanities, and infiltrates into the body politic of a nation comprising true scholars among its people. It is one of the imponderables of civilization and the more our nation indulges in it and fosters it the higher will our civilization be.

The men who live in the hearts of the human race as a source of inspiration and greatness are those that have unconsciously contributed to civilization out of the greatness of their souls and their work. It is not the great financier, the captain of industry, or the merchant prince who lives through the ages, but rather the men who have "contributed materially to the fulfillment of man's destiny and bequeathed to future generations some new particle of truth, of beauty, of justice"—a Michael Angelo, a Newton, a Shakespeare, a Darwin, a Pasteur, a Franklin, a Lincoln. It is the spirit of such men that lives in a people and makes a nation truly great. Lowell in commenting on the industrial accomplishments of this nation put the whole matter most aptly when he said it is

> with quite another oil that those far-shining lamps of a nation's true glory, which burn forever, must be filled. It is not by any amount of material splendor or prosperity, but only by moral greatness, by ideas, by works of imagination that a race can conquer the future. . . . Of Carthage, whose merchant fleets furled their sails in every part of the known world, nothing is left but the deeds of Hannibal. . . . But how large is the space occupied in the maps of the soul by little Athens. It was great by the soul, and its vital force is as indestructible as the soul.

This, I take it, is the spiritual force that we as students of the sciences must join hands with students of the humanities in maintaining and increasing in the world. And I am constrained to believe that, despite the apparent zeal for material development in this country, this spirit of moral greatness has ever been present here although, at times, it may have slumbered. If anything has been clearly demonstrated during the last five years it is that there are multitudes of young men and women that are ready and eager to give their all even unto death for truth and its corollaries, justice, freedom, and democracy. And it is appropriate that we here dedicate ourselves to the furtherance of this spirit and that we here resolve that we shall maintain it and if possible increase it in our beloved nation. It is you young men and women who must take the torch of intellectual idealism borne by many of your illustrious predecessors and pass it undimmed through the coming years to your successors.

Glenn W. Herrick

Cornell University

USES OF PLANTS BY THE INDIANS

Probably many who are interested in wild plants have wondered what uses were made of them by the Indians before white men came. Dr. Melvin R. Gilmore has recently published[1] such an account (relating chiefly to the region of Nebraska) which it has seemed desirable to review in the following form.

While we are familiar with the changes

1 "Uses of Plants by the Indians of the Missouri River Region." In Thirty-third Ann. Rept. Bur. Am. Ethn. (1911–1912), pp. 43–154, 33 pl., 1919.

in the flora which have taken place since the occupation by white men, we know little of the influence of the natives previous to that time. The early explorers made little attempt to learn what the Indians knew about plants and since that time such knowledge has become increasingly difficult to obtain.

Their cultivated crops were corn, beans, squashes and pumpkins with several varieties of each; also tobacco (*Nicotiana quadrivalvis*), all probably of Mexican origin. Apparently they did not cultivate the wild plants which grew about them but must have scattered many of them by accident during their travels. Sunflowers were cultivated by the North Dakota tribes and some others, but not by those of Nebraska so far as known. Dr. Gilmore suggests that a sort of watermelon described by the different tribes as formerly cultivated among them may have been native to America. The chief evidence of this is the abundance of the fruits among various tribes as reported by early explorers.

About 200 species of plants are enumerated with notes upon their uses as well as the Indian names and their derivation in the Dakota, Omaha, Winnebago and Pawnee languages. In the following summary the plants have been grouped according to their uses.

Food.—In addition to cultivated crops, common wild fruits and nuts, the grains of wild rice, tubers of yellow lotus and roots of tipsin (Dakota name of *Psoralea esculenta*) were of special importance. The remainder include mushrooms (elm caps, morels, three species of puffballs, a bracket fungus, also corn smut), tubers of arrow-leaf, Indian potato (*Apios*) and Jerusalem artichoke; subterranean fruits of ground bean (*Falcata*), seeds of wild flax (*Linum lewisii*), berries of ground cherry (*Physalis heterophylla*), fruits of prickly pear, bulbs of wild onion and wood sorrel. Tender tops of lambsquarters and stem bases of bulrush (*Scirpus validus*); young sprouts, flower buds and green pods of milkweed; sugar from hard and soft maple, also box-elder. In time of shortage stems of prickly pear, fruits of wild rose and red haw were used.

The nutritious roots of tipsin were dug in quantities in spite of the difficulty of securing them. They were used fresh or peeled and braided in strings to dry for winter use. The tubers of yellow lotus, also the fruits of plums, sand cherries and chokecherries were dried for winter, the entire fruits of the latter being first pounded into a pulp.

Beverages, Etc.—Dried leaves of red root, fragrant giant hyssop and coneflower (*Ratibida*), also young leaves of wild strawberry and raspberry for tea; leaves of sumac, bearberry and bark of red dogwood for smoking; resin of compass plant and skeleton weed (*Lygodesmia*) for chewing gum.

Arts and Crafts.—Elm for lodge posts, mortars and pestles; osage orange for bows; ash for bows and pipe-stems; rough dogwood for arrow shafts; willow for baskets. *Yucca* leaves, nettle stems and inner bark of basswood for fiber, sloughgrass (*Spartina*) for thatching, big blue-stem (*Andropogon furcatus*) to support the earth covering of the lodges; bulrush stems for matting, birch bark for household utensils and torches. Lichens (*Parmelia borreri* and *Usnea barbata*), buds of cottonwood, roots of black walnut, blood root and sumac for dye. Roots of *Yucca* for soap; juice of prickly pear for mucilage; down of cat-tails for pillows and bandages; stems of scouring rushes for polishing. On the treeless plains *Yucca* leaves bound together served as a fire drill, the dried stem as punk.

Ornament.—Seeds of *Erythrina*, China berry and wild cucumber (*Micrampelis*) for beads, sweet grass, sweet clover, wild bergamot, fragrant bedstraw (*Galium triflorum*), fruits of meadow rue and prickly ash, seeds of columbine for fragrance; berries of pokeberry for stain. Of the wild bergamont the Pawnee recognized four forms which differed in fragrance.

Toys.—Pembina[2] stems for popguns, the wadding being nettle fiber, inner bark of elm,

[2] A corruption of the Chippewa name for *Viburnum opulus*. Dr. Gilmore states that it is already in use by the people of northern North Dakota and Manitoba, and suggest that it be adopted in place of the inappropriate "high-bush cranberry."

birch bark or tops of *Artemisia*. Cottonwood leaves for toy tipis and moccasins, the green pods for beads. Pods of spider bean (Pawnee name for *Acuan*) black rattle-pod (*Baptisia bracteata*) and little rattle-pod (*Astragalus carolinianus*) for rattles. Jack-in-the-pulpit seeds were used in gourds for rattles.

Medicine.—Roots of hop, canaigre, wild four-o'clock (*Allionia*), wind flower (*Anemone canadensis*), blue cohosh, wild black currant, wild liquorice, prairie clover, sumac, purple mallow (*Callirrhoe*), sweet cicely, cow parsnip, gentian (*G. puberula*), butterfly weed, bush morning glory, ground cherry (*P. lanceolata*), wild gourd, purple cone-flower, cup plant and burdock.

Leaves of red cedar, curled dock, pasque flower, wild liquorice, spurge (*E. serpyllifolia*), sumac, touch-me-not, verbena (*V. hastata*), wild bergamot, rough pennyroyal and fetid marigold. Tops of cow parsnip, wild mint, broom-weed (*Gutierrezia*), sticky head (Pawnee name for *Grindelia*), milfoil and wild sage (*Artemisia* spp.). Flowers of lily (*L. umbellatum*) and false lupine (*Thermopsis*). Berries of red cedar, seeds of hop and sunflower.

Corms of Jack-in-the-plpit and blazing star; rootstocks of sweet flag and blue flag; bark of roots of oaks and Kentucky coffeetree; inner bark of red elm, stems of skeleton weed.

The greater number of these were steeped in water and used for various ailments, most commonly fevers and intestinal disturbances. A few, such as sweet flag and purple coneflower, were used in various ways. Cedar twigs, roots of purple mallow and cup plant were burned and the smoke inhaled for colds; flowers of false lupine were burned for rheumatism, the smoke and heat being confined to the affected part by a close covering.

Crushed leaves of dock were applied to draw suppuration, of sumac for poisoning, of touch-me-not for rash; roots of sweet cicely and cow parsnip for boils. Roots of butterfly weed were eaten raw for throat and lung trouble.

The fine stems of leadplant, rabbit foot (Pawnee name for *Lespedeza capitata*) and an aster were broken into short pieces, attached to the skin by moistening one end with the tongue, and burned for neuralgia and rheumatism. [This treatment, known as moxa, is found elsewhere and an Asiatic species of *Artemisia* is named *A. moxa*.] The collecting of roots of wild gourd and butterfly weed was done only by certain persons of the tribe.

Charms and Ceremonies.—Mystic properties were assigned to cottonwood, ash yellow lotus, wild gourd and cardinal flower. Flowers of pasque flower, spiderwort and wild rose were revered. Fruits of long-fruited anemone were used for luck at cards; seeds of columbine, love seed (*Cogswellia daucifolia*), roots of bloodroot and ginseng, roots and flowers of cardinal flower, plants of dodder and fuzzy top (*Artemisia dracunculoides*) for love charms. Sweet grass and wild sage (*Artemisia* spp.) for incense.

Poison ivy was known and dreaded. Moonseed was called "thunder grapes," "ghost fruit" and "sore mouth," while spurges and *Parosela enneandra* were regarded as of poisonous nature. The juice of red false mallow and purple coneflower were used to make skin insensible to heat. The compass plant was associated with lighting and its dried root burned during storms. Cedar boughs were placed on tipis for the same purpose.

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SCIENTIFIC EVENTS

AGRICULTURE IN ALASKA

THE Department of Agriculture's experiment stations located in Alaska have demonstrated that Alaska is not only a food-producing country but that if the latent resources of the territory are developed the Alaska wheat fields are destined to play an important part in the economic life of the nation. The twenty-first annual report of the Alaska Experiment Station is now available. When it is considered that one of the experiment stations is located in the Yukon Valley only 75 miles

from the Arctic Circle, where the yearly frost-free period is about 97 days, some appreciation can be had of the difficulties that prevail.

According to the report, the Sitka station propagates and tests, and to some extent disseminates, all manner of plants that promise to be useful in Alaska. The chief line of work at the Fairbanks station is the growing of grain, the testing of the adaptability of varieties of grain, and the dissemination in small quantities of the surplus seed grain produced. At Rampart, the chief lines of work are the production of new varieties of wheat, barley and oats by means of hybridization, the testing and selection of hybrids, and the increase of those proving valuable. Hardy alfalfa is grown, as well as vegetables, for the purpose of ascertaining the best cultural methods to be pursued. Cattle and sheep breeding work is conducted at the Kodiak station, and at Matanuska experiments are made with growing grain and sugar beets. A small nursery has also been started here for propagating hardy nursery stock for distribution in the Matanuska Valley.

In 1918 a distribution of seed grain was made to a number of farmers in the Tanana Valley in an effort to induce them to begin grain production on an independent basis. The results were so satisfactory that the experiment was repeated in 1919. In that year 22 farmers in the Tanana Valley produced 1,128 bushels of spring wheat, 2,811 bushels of oats, and 121½ bushels of barley. During the same season the station at Fairbanks produced 303 bushels of spring wheat, 774 bushels of oats, and 125 bushels of barley. A small flour mill was installed at the Fairbanks station in 1918, where Alaska-grown wheat has been milled into an excellent bread flour.

The 1918 report of the Alaska Agricultural Experiment Stations can be had upon request of the United States Department of Agriculture, Washington, D. C.

REPRODUCTION OF MICROSCOPIC UNDER-SEA LIFE

The American Museum of Natural History has reproduced in glass and wax a two-inch section of sea-bottom, with its characteristic plant and animal life, magnified more than 15,000 times. The exhibit is known as the Bryozoan Group, taking its name from the sea-animals popularly called sea-mats and sea-mosses, which it principally depicts.

The shells of these minute organisms form encrustations on sea-weeds and pebbles and on shells of larger animals. They are extremely beautiful in their intricate form and coloring. The "plumed worm" has especially fine colors. Other microscopic creatures and marine plants combine to make this group of especial interest.

The glass-blowing was done by Mr. Herman Mueller, and the coloring by Mr. Show Shimotori, while the wax portions of the group are the work of Mr. Chris E. Olsen. The entire exhibit was prepared and assembled under the expert direction of Mr. Roy W. Miner, associate curator of the department of invertebrate zoology.

MATTERS OF SCIENTIFIC INTEREST IN CONGRESS[1]

The bill for a tariff on scientific instruments, etc. (H. R. 7785) was brought up on the Senate calendar on April 5, but was passed over. On April 28, Mr. Knox offered an amendment providing for the exemption from import duty of "guaranteed disks, ten inches or more in diameter, for astronomical telescopes."

The appropriations in the Second Deficiency Act include: $75,000 for continuation of the investigation of the mineral resources of Alaska, to be available also during 1921; and $47,100 for the continuation of magnetic and geodetic work by the Coast and Geodetic Survey.

The legislative, executive and judicial appropriation bill (H R. 12610), carrying appropriations for the Bureau of Standards, passed the House on March 4, and the Senate on April 1. After agreement to the conference reports the bill was sent to the President, carrying an amendment introduced by Mr.

[1] From the *Proceedings* of The Washington Academy of Sciences.

Smoot on April 1 to the effect that no governmental journal, magazine, or periodical should be printed, issued, or discontinued without the approval of the joint committee on printing. On account of the inclusion of this amendment the President vetoed the bill on May 13. The paragraph was eliminated and the bill repassed and signed as Public Law No. 231.

The act includes $432,360 for salaries at the Bureau of Standards, together with many special research items of which the following are examples: fire-resisting properties of building materials, $25,000; development of color standards, $10,000; optical glass, $25,000; metallurgical research, $25,000; sugars and sugar-testing apparatus, $30,000; high temperature measurement and control, $10,000. Total for the Bureau, $1,217,360.

A joint resolution looking toward an even more comprehensive reorganization of the executive departments than that contained in the Jones-Reavis bill was introduced as H. J. Res. 353 on May 7 by Mr. Madden. The resolution provides for a Joint Committee on Reorganization consisting of three members each from House and Senate. Referred to the Committee on Rules.

Another reorganization and consolidation measure is S. 4369, introduced by Mr. Henderson on May 12: "To create a Division of Mines and Geology in the Department of the Interior." The proposed Division would be under the direction of an Assistant Secretary of the Interior, "technically qualified by experience and education," at a salary of $10,000. The powers and duties of the present Geological Survey and Bureau of Mines, and any powers and duties of other federal agencies relating to mining, metallurgy, mineral technology, geological surveying, land classification, or mineral resources, would be transferred to the new Division. The bill was referred to the committee on Mines and Mining.

THE MEETING OF ORIENTALS AND OCCIDENTALS IN THE PACIFIC COAST AREA

A SCIENTIFIC symposium on this subject will be held in San Diego and La Jolla, California, from August 1 to 13. It will consist of special technical discussions at Scripps Institution, La Jolla, and public addresses with opportunities for questions at the community center of the Unitarian Church, San Diego.

The initial assumption made for the discussion is: All particular difficulties rest back on a world problem of three-fold aspect: (*a*) The aspect of world population. (*b*) The aspect of world supply of "raw material" and "manufactured goods" for sustaining the world population. (*c*) The aspect of world civilization.

The program is as follows:

INTRODUCTORY

Statement, pro and con, of the troubles due to oriental migration, particularly into the Pacific Coast states of North America: WALTER B. PITKIN, school of journalism, Columbia University.

THE WORLD PROBLEM

(*a*) *In its population aspect* (*its numerical phase only*): W. C. THOMPSON, sociologist, department of agriculture, Cornell University.

(*b*) *In its material supplies aspect:* E. M. EAST, plant genetics, Bussey Institute, Harvard University.

(*c*) *In its civilizational aspect:* WM. E. RITTER, biologist, Scripps Institution for Biological Research, University of California.

The general oriental-occidental problem: DR. GILBERT REID, director-in-chief, International Institute of China.

LOCAL ORIENTAL-OCCIDENTAL PROBLEMS OF PACIFIC NORTH AMERICA

(*a*) *"Cheap labor" problem; "standard of living" problem; "race prejudice" problem:* W. C. THOMPSON.

(*b*) *The general and special problems of rural life and agricultural industry:* ELWOOD MEAD, professor of rural institutions, University of California.

(*c*) *The "fertility" problem; the "miscegenation" problem:* S. J. HOLMES, department of zoology, University of California

(*d*) *The problem of conflicting national policies:* E. T. WILLIAMS, professor of oriental languages and literature, University of California.

SCIENTIFIC NOTES AND NEWS

Professor Leonard Eugene Dickson, of the department of mathematics at the University of Chicago, has been elected a corresponding member of the French Academy of Sciences. At a complimentary luncheon to Dr. Dickson at the Quadrangle Club, Professor A. A. Michelson, head of the department of physics, presided and welcomed Dr. Dickson to membership in the academy. Other speakers were Eliakim Hastings Moore, head of the department of mathematics; Thomas C. Chamberlin, former head of the department of geology, and Forest Ray Moulton, professor of astronomy.

At the eighty-eighth annual meeting of the British Medical Association, held at Cambridge, the president Sir T. Clifford Allbutt, chose as the subject of his address, "The Universities in Medical Research and Practise." At the conclusion of his address the president was presented with his portrait, the work of Sir William Orpen, which had been subscribed for by a great number of physicians. Sir Norman Moore, president of the Royal College of Physicians made the presentation address.

Dr. David Drummond, vice-chancellor and professor of the principles and practise of medicine, University of Durham, has been elected president of the British Medical Association and will preside at the meeting to be held next July at Newcastle-on-Tyne.

Among the foreign guests at the Cambridge meeting of the British Medical Association were: Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute and Professor J. Abel, professor of pharmacology, The Johns Hopkins University.

Colonel F. F. Russell has resigned from the Medical Corps, U. S. Army, to take charge of the newly organized Division of Public Health Laboratories of the International Health Board of the Rockefeller Foundation.

Mr. E. A. Holbrook, formerly superintendent of the Pittsburgh branch of the Bureau of Mines, has been transferred to Washington as assistant to the director, Dr F. G. Cottrell, whose nomination has been confirmed by the Senate.

J. M. Hill, of the United States Geological Survey, has been transferred from Washington to the survey's office in San Francisco, where he will be associated with Charles G. Yale. Mr. Hill's field of geological studies will include the Pacific coast states and to some extent also Arizona and Nevada.

Mr. Alan Ogilvie who resigned the readership in geography of the University of Manchester, has joined the staff of the American Geographical Society of New York.

Dr. Seymour Hadwin has resigned his position as chief pathologist in charge of the biological laboratory, health of animals branch, Canadian Department of Agriculture, at Ottawa, and has taken a position as chief pathologist in the reindeer investigations of the Bureau of Biological Survey, United States Department of Agriculture, with headquarters at Unalokleet, Alaska.

Dr. S. Josephine Baker has been made consultant in child hygiene for the U. S. Public Health Service and has received a commission as surgeon in the reserve of the U. S. Public Health Service.

Dr. J. S. Flett has been appointed director of the Scottish Geological Survey and Museum to succeed Sir Aubrey Strahan.

Dr. Ludwik Silberstein, formerly of Adam Hilger, Ltd., of London, is now associated with the Research Laboratory staff of the Eastman Kodak Company. Dr. Silberstein is known for his mathematical papers dealing with electro-magnetism, optics, theory of relativity, projective geometry, spectrum theory, etc.

Dr. Harrison E. Patten has resigned from the Bureau of Chemistry of the U. S. Department of Agriculture, to accept the position of chief chemist with a St. Louis firm.

Kenneth P. Monroe has resigned as chemist in the color laboratory, United States Bureau of Chemistry, Washington, to accept a research position in the Jackson Laboratory of E. I. du Pont de Nemours Company, Wilmington, Del.

DR. W. VAN BEMMELEN, director of the magnetic and meteorological observatory at Batavia, Java, is visiting the laboratories and institutions of the United States.

DR. CHARLES D. WALCOTT, of the Smithsonian Institution, is spending the summer as in other years in geological and paleontological work in the Canadian Rockies.

DR. HUBERT LYMAN CLARK, of the Museum of Comparative Zoology of Harvard University, has been given leave of absence to be acting-professor of zoology at Williams College during the next academic year. He takes the place of Professor J. L. Kellogg, who will spend the year at Claremont, California.

DR. BARTON WARREN EVERMANN, director of the museum of the California Academy of Sciences, sailed for Honolulu on July 28 to attend the meetings of the Pan-Pacific Scientific Congress. The authorities of the Bishop Museum have asked Dr. Evermann, while there, to identify certain fishes in that institution. He will return to San Francisco about the end of August.

ACCORDING to the *Proceedings* of the Washington Academy of Sciences among those in attendance from Washington at the scientific congress to be held in Honolulu during August will be: Paul Bartsch, of the National Museum; William Bowie, of the Coast and Geodetic Survey; T. Wayland Vaughan, of the U. S. Geological Survey; H. S. Washington, of the Geophysical Laboratory, Carnegie Institution of Washington, and H. O. Wood, of the National Research Council.

DR. G. DALLAS HANNA and W. P. Zschorna, of the Bureau of Fisheries, have gone to the Pribilof Islands. Dr. Hanna has charge of the taking of the census of fur seals this summer; Mr. Zschorna is to continue experiments inaugurated in 1919 for improving methods of taking and curing sealskins.

DAVID B. REGER, of Morgantown, W. Va., is on leave of absence from the West Virginia Geological Survey for the next four months and will devote that time to consulting work in petroleum and coal. He has just completed a months trip to the prospective oil fields of Montana.

MR. H. P. v. W. KJERSKOG-AGERSBORG, assistant in zoology, Columbia University Extension Teaching, sails on the Swedish steamer *Drottningholm* for a six week's study of the Littorine Gasteropod fauna in fjords of arctic Norway. The Melfjord, which is the most southern of the arctic fjords offers an exceptional point of ecological interest owing to its greatly diversified type of shore-lines.

AT the annual meeting of the American Climatological and Clinical Association held in Philadelphia in June, the following officers were elected: president, Dr. Carroll E. Edson, Denver; vice presidents. Drs. Nelson Estes Nichols, Portland, Me., and Gordon Wilson, Baltimore, and recorder, Dr. Cleveland Floyd, Boston.

THE Eugenics Education Society has arranged for the holding of a summer school of eugenics and civics at Herne Bay College on July 31-August 14. The inaugural address will be delivered by Professor A. Dendy on "Evolution in Human Progress."

It is proposed by the Swedish Linnean Society to restore the old botanic garden at Upsala, together with the house in it, the former residence of Carl von Linné.

TRIBUTE to Wilbur Wright was paid by France on July 17, when a stone column supporting the undraped figure of a man was unveiled in the Place Jocobins at Le Mans.

THE Journal of the American Medical Association announces the deaths of the following men known for their contributions to medical science: Dr. Demons, formerly professor of surgery at the University of Bordeaux; Dr. T. Barrois, professor of parasitology at the University of Lille; Dr. R. Kretz, privat-docent of pathologic anatomy at the University of Vienna; Dr. T. Debaisieux, former professor of surgery at the University of Louvain, at one time president of the Belgian Academy of Medicine and of the Belgian Surgical Association, and Dr. F. Schatz, former professor of gynecology and obstetrics at the University of Rostock.

The death is also announced of Professor Max Fürbringer, the well known comparative anatomist of Heidelberg.

M. Eugene Aubourg de Boury died on April 17, in France, at the age of sixty-three years. A correspondent writes that M. de Boury, though a long-time invalid, had devoted himself with ardor to the study and collection of mollusks of the genus *Scalaria*. He gathered in the last ten years an extraordinary collection of these beautiful and rare shells for the Paris Museum of Natural History, increasing their series from 300 sets to 3,000, exclusive of photographs and illustrations of inaccessible species to the numbers of 1,800 more. This series far surpasses any other extant. He published numerous papers on the genus and indicated many new subdivisions of it, but the great monograph which was his ideal must remain for other hands to prepare.

Under the able guidance of Mr. Jasper E. Crane, a cellulose symposium was organized as a part of the program of the Division of Industrial and Engineering Chemistry at the St. Louis meeting of the American Chemical Society last April. One of the objects of this symposium was to ascertain whether a cellulose section, if formed, would secure the interest and support of a sufficiently large number of chemists. The object of such a section would be to promote intercourse and cooperation between the chemists in the various cellulose industries. This group constitutes one of the largest and most important of American industries; all branches of it are intimately concerned in the problems of cellulose, and it seems highly desirable to promote technical activity in this country along these lines. The proposed section would serve as a clearing-house for papers and information on cellulose technology, and should also play an important part in promoting research on the chemistry of cellulose. The symposium at St. Louis was distinctly successful, and it was voted to hold a second cellulose symposium under the auspices of the Industrial Section at the Chicago meeting during the week of September 6. At this time, the advisability of forming a permanent cellulose section will be considered. An interesting program is being arranged, and a large attendance of those interested in cellulose is anticipated. Titles of papers or suggestions for the symposium should be sent to G. J. Esselen, Jr., 30 Charles River Road, Cambridge, 39, Massachusetts.

The British Medical Journal states that the University of Paris has come to an understanding with the French government, through the minister of health, and buildings have been found in Paris which can be converted into a large institute of hygiene. It will be under the general direction of the professor of hygiene, Dr. Léon Bernard, but there will be five sections, each with its director. It will have sections of epidemiology, of social hygiene, food, of industrial hygiene, and of sanitary technology; and a series of laboratories—of bacteriology, chemistry, physics, and physiology—a museum, a library and lecture rooms. Courses of lectures of two standards will be given, the one elementary, for ordinary students of medicine, and the other advanced, for doctors proposing to specialize in hygiene. Instruction will also be given to persons employed in disinfection and as health and school visitors. It is hoped eventually to extend the opportunities for study by establishing courses for architects, engineers and statisticians. The food section will comprise three departments, the first dealing with the chemistry of foods and of adulteration, the second with the damage done by parasites and microbes, the third with the physiology of food and nutrition. An institute of hygiene on similar lines is also being established in the University of Strasbourg.

We learn from *Nature* that the bequests of the late Rr. Rudolf Messel include: £5,000 to the Royal Institution of Great Britain; £1,000 to the Chemical Society; £2,000 and his platinum still, "in which I carried out with W. S. Squire my experiments in connection with the decomposition of sulphuric acid," to Mr. Squire, requesting him on his death to leave it to the Society of Chemical Industry; his platinum

crucible to the Society of Chemical Industry; and his electric telephone by Reis to the Institution of Electrical Engineers. The residue of the property is to be divided into five parts, four of which are to go to the Royal Society and one to the Society of Chemical Industry, the wish being expressed that the fund shall be kept separate from the funds of the society the capital to be kept intact, and the whole of the income expended in the furtherance of scientific research and other scientific objects, and that no part thereof shall be applied for charitable objects, as the granting of pensions and the like.

THE *Journal* of the American Medical Association states that what is reported as the largest medical conference ever assembled in the capital of China was held February 21–28, of the present year. Over 300 delegates were present, including 210 medical missionaries. A message from the minister of education of China was read which stated the following as the educational policy for the immediate future in that country: (1) To establish new medical schools as soon as conditions will allow on the basis of one medical school for each province. (2) To improve and extend such schools as were already established. (3) To encourage the study of medicine and to maintain for the scientifically trained doctors a high social status aiming at a sufficient number for this important profession. (4) To cause to be organized at proper localities such institutions or facilities of investigation as will aid specialists in their own research work. (5) To regulate the practise of doctors trained in the traditional way with a view to the unification of standards required of medical practitioners.

UNIVERSITY AND EDUCATIONAL NEWS

IT is planned to establish eight new professorships at Cornell University to commemorate the war services of 7,800 Cornell men.

DR. H. R. KRAYBILL, of the Bureau of Plant Industry, has been appointed professor of agricultural chemistry and head of the department of chemistry of the New Hampshire State College.

P. W. WHITING, in charge of biology at Franklin and Marshall College, Lancaster, Pa., has resigned to accept a position at St. Stephen's College, Annandale-on-Hudson, N. Y.

PROFESSOR C. F. CURTIS RILEY has been promoted to a full professorship in the department of forest zoology, Syracuse University.

JOHN T. METCALF, Ph.D. (Yale, '13), psychological examiner with the Illinois Department of Public Welfare, has been appointed assistant professor of psychology in George Washington University.

DR. L. V. KING has been appointed Macdonald professor of physics at the Macdonald Physics Building, McGill University, from which he received his bachelor's degree in 1905. The chair to which Dr. King has been promoted has been held in succession by Professor H. L. Callendar, Professor, now Sir Ernest Rutherford, Dr. H. T. Barnes, Professor H. A. Wilson, and by the present director, Dr. A. S. Eve.

AT the University of Sheffield, Dr. W. E. S. Turner has been appointed professor of glass technology, Mr. J. Husband professor of civil engineering, Dr. Mellanby professor of pharmacology.

DISCUSSION AND CORRESPONDENCE

GENERA AND SUPERGENERA

TO THE EDITOR OF SCIENCE: I sympathize with Dr. Witmer Stone (SCIENCE, N. S., 51: 427, 1920) in his wish to preserve in generic names an expression of taxonomic relationships. Dr. Stone advocates the adoption of "an arbitrary set of genera *de convenience* so far as nomenclature is concerned and use subgeneric terms when we desire to call attention to more refined phylogenetic groups." I would call attention to the results of a practical application of this system. If I understand the proposed system correctly the genera for general use would stand toward the genera for technical use (since the latter

would be subgenera) in the relation of a supergenus to a genus. Suppose we apply this to the well-known genus *Panicum* among the grasses. There has been a tendency in the historical development of this Linnæan genus to split off one after another species or groups of species to form new genera. Even as limited by the avowed "splitter" the genus still includes hundreds of species. The more conservative botanists include as subgenera, *Digitaria* (*Syntherisma*), *Echinochloa, Trichachne* (*Valota*), *Thrasya, Echinolæna, Hymenachne, Sacciolepis,* and several more, in some cases, even *Setaria* (*Chætochloa*). I should be willing to use *Panicum* in the broader sense, but for the sake of consistency I should want to include under *Panicum* such genera as *Paspalum and Ichnanthus.* I think that the technical characters that separate these last from *Panicum* are no greater nor more important than those which separate *Digitaria* and *Echinochloa* from *Panicum.* But *Paspalum* and *Ichnanthus* have been considered distinct genera by most botanists for over 100 years. *Paspalum* is a Linnæan genus and includes probably more than 200 species. The practical question then arises, if the grasses are arranged in genera which are really supergenera on the basis of the relative importance of technical characters, the more technical groups appearing as subgenera, will the layman—or the botanist who is a layman in relation to the taxonomy of grasses—gain in convenience. Many well-known genera will disappear. *Bromus* and *Festuca, Sporobolus* and *Muhlenbergia, Trisetum* and *Deschampsia* (*Aira*), are as closely allied as *Panicum* and *Digitaria.* If *Digitaria* is placed as a subgenus of *Panicum* then one feels as if he must place *Sporobolus* as a subgenus of *Muhlenbergia* and so on. The layman is chiefly concerned with the stability of the names he uses. The method just outlined would, I think, be just as confusing to him as the "splitting" of which Dr. Stone speaks. It is very difficult to devise a nomenclature which shall adapt itself to the normal growth of a living science and yet have the kind of stability that the layman wants.

It has been assumed by some that the Linnæan concept of genera was a broad one, that his genera are what we are calling supergenera, and that later botanists have been splitting off fragments, or dividing along convenient cleavage lines, to form our modern genera. This assumption scarcely accords with the facts. He seems to have established genera according to his knowledge, his convenience, or sometimes apparently by a mere whim, if one is to judge by his grass genera. *Bromus* and *Festuca* are Linnæan genera that remain much as he left them; *Panicum* and *Andropogon* are supergenera; *Holcus* and *Aira* are assemblages of unrelated species or groups of species.

I believe there would be considerable confusion in the application of the concept of supergenera; and the names of the supergenera would be subject to continual change as our knowledge of relationships increased. Nevertheless, as a general principle, I think it is desirable to retain minor groups of species as divisions of genera rather than to recognize them as genera.

A. S. Hitchcock

Washington, D. C.

THE SITUATION OF SCIENTIFIC MEN IN RUSSIA

To the Editor of Science: In your issue of April 23 there is reproduced a letter from Professor Babkin, of the University of Odessa, in which the following statement occurs:

> The bolshevic revolution has brought Russia into such a state that not only has scientific work come to a standstill, but even our lives are in danger.

One is very much tempted to discuss the situation of scientific men in Russia, but it is perhaps better simply to quote testimony from impartial sources. There is, however, one remark which must be made with regard to Babkin's statement, namely, that Odessa is very far removed from the limits of the Federated Soviet Republic, being in the region (Ukraina) dominated by the anti-bolshevic forces.

I happen to have before me a book published recently by Gauthiers-Villars et Cie,

Paris, entitled "Etudes de Photochimie" par Victor Henri. The front page of the book bears this further legend: Professor Henri, formerly assistant director of the "Ecole des Hautes Etudes" (Sorbonne), and much to my amazement at present "Directeur de laboratoire à l'Institut scientifique de Moscou."

I open the book with curiosity and read in the preface that this great work on photochemistry was begun by the author in Paris but since the war "la photochimie fut oubliée." In 1915 it was Henri's good fortune to be dispatched to Russia on an official war mission. Then the revolution broke out and —but here I make room and let Professor Henri tell his own story:

> La révolution russe arriva avec toutes ses phases. Un souffle de vie nouvelle se leva. Un espoir d'organization scientifique générale amenant le progrès, c'est-à-dire augmentant la somme de bonheur de l'humanité, se réveilla et une période de vie active commença en Russie, à laquelle je fus mêlé à Moscou. L'Institut scientifique de Moscou me donna un accueil très chaleureux; l'Université de Moscou m'offrit une chaire; la Commission de l'Académie des Sciences de Russie pour l'étude des richesses naturelles de la Russie me demanda d'être le secrétaire scientifique de la section de Moscou.

S. MORGULIS

THE CREIGHTON UNIVERSITY,
OMAHA

CONCERNING OUR RELATIONS WITH TEUTONIC SCIENTISTS

TO THE EDITOR OF SCIENCE: I fear that Professor Henry Fairfield Osborn's letter in SCIENCE, June 4, 1920, quoting from and commenting upon letters from my esteemed friend Arrhenius and another colleague, will convey to many readers an erroneous impression in one very important particular, namely: that there are scientists in the entente countries who would restrict the interchange of publications with scientists in the Teutonic countries. If there are any such entente scientists, I have not heard of them. I can safely parallel Professor Osborn's statement, "We paleontologists welcome the works of Othenio Abel," by saying that "We astronomers welcome the works of Struve (Berlin) and von Hepperger (Vienna); we shall read these works as carefully as we have read those issued by them in 1913 and earlier; and as soon as peace is declared we shall unreservedly do our part in arranging that Struve and von Hepperger and their colleagues receive the published writings of American astronomers.

In the relief of present-day distress and suffering in enemy nations, to which the quoted Stockholm and Vienna letters refer, I feel sure that all American scientists are glad to contribute in accordance with their abilities, and without question as to what occurred in 1914–18. I doubt if any appeal for assistance from this country has been made in vain.

There still remains the question of personal relationships in the future. Professor Osborn has quoted from one of the European letters as follows: ". . . *every German believed* [*in 1914*] *a war would be much cheaper than the steadily increasing military expenses.*" This undoubtedly assumed, on the part of "every German," that the war would be short, that Germany would win it, and that Serbia, France, and Russia would pay the bills! In this precise connection should the world be permitted to forget that Germany would not consent to a reduction of armaments when the other nations at the Second Hague Conference in 1907, made and urged this proposal?

Professor Foerster, of the University of Munich, was quoted throughout the world early in 1919 about as follows: "We Germans have only ourselves to blame for the *moral blockade* which hems us in, and the raising of this blockade depends upon ourselves alone." Whether the quotation is correct or not, it faithfully represents widely prevailing opinion in entente scientific circles.

W. W. CAMPBELL

MOUNT HAMILTON,
June 11, 1920

QUOTATIONS

MEDICAL EDUCATION

DURING the last thirty years the feeling has become increasingly insistent, both in this

country and in America, that certain radical reforms were needed in the methods of education in medicine. But our American colleagues have been fortunate in having the opportunity and the means for building new schools of medicine to meet the new circumstances and for making drastic changes in their methods of teaching which a variety of circumstances has hitherto prevented us from attempting in Britain. Now that the Rockefeller Foundation, by its magnificent generosity, has made it possible for us to embark upon the difficult sea of reform, it is particularly interesting and instructive to study the policy adopted in the more advanced schools of America during the twenty-seven years since the Johns Hopkins Medical School gave the study of medicine in America a new aim and a higher ideal. Though we are a quarter of a century behind our American colleagues in making a start, our delay has given us the advantage that we can profit by the experiments made on the other side of the Atlantic.

It is not generally recognized here how thoroughly the leaders of medical education in America explored every possible method of education throughout the world, and how much devotion and thought they have expended on experiments to discover, by truly scientific methods, how best to employ the few years that the medical student can devote to the training for his profession. Those who want to understand something of the spirit and the high deals that have inspired the American leaders in this great reform movement should read the account of their work and aims in the volume "Medical Research and Education," issued by the Science Press in New York in 1913. Briefly expressed, the matters upon which chief insistence is placed are as follows: The absolute necessity of (*a*) an adequate preliminary education and a serious university training in the basal sciences, physics, chemistry, and biology, without which foundation it is impossible for the student really to profit from his training in medical science; and (*b*) a method of practical teaching in all branches of professional work, whereby the student can, so far as possible, investigate for himself the facts and theories of each subject under the direction of men who are themselves engaged in research work, and not rely mainly upon lectures and demonstrations to give him merely the *results* of other people's work. In other words, the aim of the reform is to train the student in scientific methods rather than to "cram" him with traditional lore.

* * * * * * * *

The great development in the science of anatomy during the last thirty years has been due mainly to the use of the microscope for the investigation of the structure of the body and for the study of embryology. British anatomy has been hampered by the lack of the facilities for teaching these vital parts of the subject, and has suffered enormously from the lack of stimulating daily contacts with them. In other countries, and especially in America, the cultivation of histology and embryology has not only made anatomy one of the most active branches of medical study and research, but also brought the work of the department into close touch with physiology, biochemistry and pathology, to the mutual benefit of all these subjects, and especially to the student who has to integrate the information acquired in the different departments. It was the radical reforms effected in the teaching of anatomy by the late Professor Franklin Mall at the Johns Hopkins Medical School in 1893 that played the chief part in starting the great revolution in medical education in America. The stimulating influence of the abolition of the methods of medieval scholasticism in anatomy and the return to the study of Nature and to the use of experiment brought about a closer cooperation with other departments and a general quickening of the students' interest in the real science of medicine.—*Nature.*

SCIENTIFIC BOOKS

A new Morphological Interpretation of the Structure of Noctiluca and its bearing on the Status of the Cystoflagellata (Haeckel). By Charles A. Kofoid. University of California Publications in Zoology, Vol.

19, No. 10, pp. 317–334, one plate, two text-figures. February 13, 1920.

Professor Kofoid, the leading student of the Flagellata, in a brief but important paper, discusses convincingly the morphology and relationship of *Noctiluca*. The data and their bearing are well indicated in the author's summary, as follows:

1. Notiluca is a tentacle-bearing dinoflagellate with a sulcus, girdle, and longitudinal and transverse flagella.

2. The sulcus is longitudinal and midventral. It includes the apical trough and the recessed oral pouch and cytostome.

3. The tentacle arises from its posterior end.

4. The girdle has hitherto been overlooked. It is a shallow trough at the left of the sulcus and at right angles to it. It is seen best in small individuals.

5. The longitudinal flagellum is reduced and lies within the oral pouch. The transverse flagellum is represented by the prehensile tooth at the proximal end of the girdle at the left of the base of the longitudinal flagellum. This organ exhibits structural undulations and spasmodic or rhythmical contractions.

6. Distention by hydrostatic vacuoles, with flotation replacing active locomotion, has led to degeneration of the flagella and their reduction in size, and to the almost complete disappearance of the girdle.

7. *Noctiluca* belongs in the Noctilucidæ, a family of the tribe Gymnodenioidæ, with *Pavillardia*, another tentaculate, naked, non-ocellate dinoflagellate.

8. There is no morphological justification of a separate order of flagellates to hold *Noctiluca*, such as the Cystoflagellata Haeckel.

9. The Cystoflagellata may be retained as thus emended to receive *Leptodiscus* and *Craspedotella* pending discovery of their affinities.

MAYNARD M. METCALF
THE ORCHARD LABORATORY,
OBERLIN, OHIO

SPECIAL ARTICLES

THE EFFERENT PATH OF THE NERVOUS SYSTEM REGARDED AS A STEP-UP TRANSFORMER OF ENERGY

THE properties of nervous tissue which fit it for its peculiar rôle in the animal economy are given by Sherrington as (1) excitability (2) spatial transmission of impulses and (3) control of the liberation of energy in contiguous tissues. Pawloff and others have emphasized the rôle of the peripheral sense organs as energy transformers, since the energy of light or heat or sound is transformed, by appropriate mechanisms, to the energy of a nerve impulse. Lucas and Adrian's all or none hypothesis of nerve conduction calls attention to another aspect of the work of the nervous system as a transformer of energy. According to this hypothesis, the nerve impulse conducted by any single nerve fiber is at all times the maximum impulse which it is capable of conducting. The evidence in favor of this view appears to be steadily accumulating, although there are still conditions under which the energy relationships are not clear. The efferent paths of the nervous system appear to me to furnish additional confirmation of the general truth of the hypothesis.

Neurologists have frequently commented on the relatively few nerve fibers in the main motor tracts of higher animals, *i. e.*, the pyramidal tracts, as compared to the number of fibers in the ventral roots of the spinal nerves and the great mass of muscles to be activated. According to von Monakow, Redlich, Schäfer and others, fibers of the pyramidal tract do not end directly about the cells of origin of the motor nerves, but about some intermediate or intercalated cells in the spinal cord. Von Monakow has supposed that each of these intermediate cells comes into relation, through the branching of its processes, with more than one motor cell in the spinal cord. Furthermore, the axone of each peripheral motor nerve may branch on its way to its effector. There is a possibility, therefore, that each descending fiber in the pyramidal tract of the spinal cord may ultimately be able to actuate several terminal axones in the peripheral motor system. Suppose that one pyramidal fiber may, through the intercalated neurone, come into relation with three cells of origin of peripheral fibers,

and that each of these peripheral fibers, in its turn, is divided into two. These relationships may be indicated diagrammatically. One pyramidal fiber may, therefore, be represented

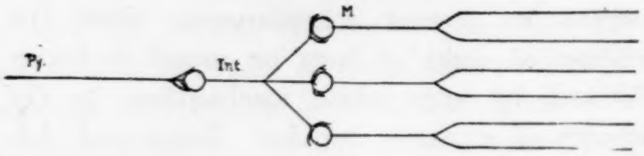

FIG. 1.

at the periphery by six branches of axones, each of which is in its turn capable of acting upon an effector. The energy, *a*, coming down the first fiber in the series, *Py*, is, according to the all or none hypothesis, the maximum which the fiber is capable of conducting. Similarly, the energy passing over the intercalated (*Int.*) fiber before its branching is also the maximum which it is capable of conducting. Suppose that it is equal to *a*. At the point of branching, the energy conducted along each branch must either be brought up to some quantity closely approximating *a*, or else it must fall to $a/3$. In the latter case, the energy passing over the proximal unbranched portion of the fiber *M* must either be brought up to the value *a*, or else in its turn be close to the value $a/3$. Going on out to the bifurcation of this fiber, there must again be a raising of the energy in each of the branches to some value closely approximating *a*, or else it must fall to a value $a/6$. There is little or no evidence that the energy of the nerve impulse falls off in any such degree in its passage from central system to periphery. The presumption is, therefore, that the efferent distribution path acts as a step-up transformer of energy, although the manner of its action is as yet unknown. It should be stated here that the nerve fiber itself furnishes the energy, derived in some manner as yet unknown from its own metabolic processes, and that there is, in all probability, no change in voltage at the expense of the amperage, as in the electrical transformers with which the physicist is familiar.

Reference to Ranson's[1] diagram of the sympathetic system will show that the same considerations apply there. In fact, the diagram given in this paper was suggested by Ranson's diagrams.

One more link in the scheme of the step-up transformer may be what Langley has called the receptive substance, interposed, chemically if not histologically, between the motor end plates and the contractile substance in muscle. It is certain that there is a great increase in the energy of a muscle contraction as compared with the energy of the nerve impulse, which, starting in the central system, finally evokes the muscle contraction at the periphery. It seems reasonable to suppose, in the light of our present knowledge, that the efferent nerve path is a part of this transformer system.

Such general relationships of the energy of the response to the energy changes in the processes preceding the response have long been recognized. Balfour Stewart[2] (p. 163) remarks: "We have seen that life is associated with delicately-constructed machines, so that whenever a transmutation of energy is brought about by a living being, could we trace the event back, we should find that the physical antecedent was probably a much less transmutation, while again the antecedent of this would probably be found still less, and so on, as far as we could trace it." We should recognize, however, that such relationships have a limit in the living organism. Otherwise, we would arrive at perpetual motion.

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ON SPIRAL NEBULÆ

ONE of the privileges of the vacation is the opportunity of making one's own tea in one's own vessels. I did so recently, aided by a deep precipitation glass, *g*, with a lip, *l*, running far down the sides. On stirring the

[1] Ranson, S. W., 1918, *Journal of Comparative Neurology*, Vol. 29, p. 306.

[2] Stewart, Balfour, 1874, "The Conservation of Energy," New York, p. 163.

liquid with a spoon, energetically, and removing the latter, I noticed that a sharply outlined spiral was *persistently* present on the surface, until the deep paraboloid returned to the plane. My explanation would be, that at l, part of the tangential velocity is converted into local vortical motion, whereby the particles at l, because of the reduced centrifugal force, slide down the inclined plane of the rotating paraboloid. From another point of view, a stationary wave is produced on the surface by the interference at l.

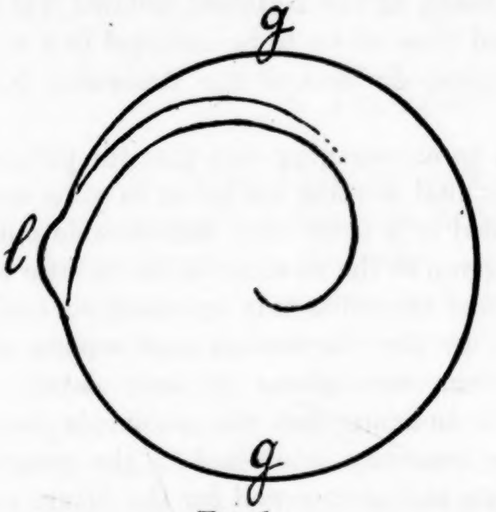

FIG. 1.

Now though I will not venture to repeat the superscript of this note, I will nevertheless ask whether something analogous to the above simple experiment may not be taking place in astronomical space. Suppose we replace the glass vessel of the figure by a gravitational mechanism; and suppose we "lip" it at l, by making that locality a region of effectively greater density and relatively at rest. If Kepler's law be written in the form so convenient in its present relations to the modern atom (M, being the virtual mass at the center and A the angular momentum per gram, whereby $rv^2 = A^2/r = M$, for the tangential velocity v at r), then any local diminution of A in accordance with the above model, would be followed by a diminution of r in the part affected.

At all events the hydrodynamic experiment (rotational surface figures, as related to shape of boundary) is very beautiful and certainly more approachable. I shall allow myself to play with more interpretable modifications of it a little longer.

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THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE Seattle meeting of the Pacific Division of the American Association for the Advancement of Science held June 17 to 19 at the University of Washington, Seattle, was perhaps the most successful so far held by the Pacific Division. Sixteen affiliated societies were scheduled in the final program and delegates were in attendance from every part of the Pacific Coast area. The representation from the University of California and Stanford University was particularly large.

The special sessions of the convention in which the various affiliated societies participated were well attended and the beneficial results of this cooperation were apparent. The conference of Research Committees from the educational institutions of the Pacific Coast held two sessions which were attended by all the delegates. The problems connected with the maintenance and encouragement of active research in the college and university were presented and discussed and some practical suggestions were made. It was felt that distinct progress in the solution of these problems had resulted from this meeting and that the research conference should be a permanent feature of the annual meetings of the Pacific Division.

A symposium on the "Einstein Theory of Relativity" was of general interest and was also well attended. In the symposium on "The Animal and Plant Resources of the North Pacific Ocean" given under the auspices of the Pacific Fisheries Society and the Western Society of Naturalists, each speaker emphasized the great need for more knowledge of the ocean and its life to save the fisheries industry. It is hoped that the means will be found to publish the papers in this symposium as a contribution to a better understanding of the importance of the projected exploration of the North Pacific Ocean through international co-

operation. This project will be further advanced at the Pan-Pacific Scientific Congress to be held in Honolulu from August 2 to 20.

Notable features of the meeting were the presidential address by Dr. John C. Merriam who spoke on "The research spirit in the every-day affairs of the average man" and the address by Professor R. W. Brock, of the University of British Columbia, on "The last crusade under Allenby." On account of illness, Dr. Charles E. St. John, of Mount Wilson Observatory, was unable to give the Sigma Xi-Phi Beta Kappa lecture. His place was supplied by Dr. Paul W. Merrill, of Mount Wilson Observatory, who spoke on "The chemistry of the stars."

Dr. William E. Ritter, director of the Scripps Institution for Biological Research, was elected president of the Pacific Division for the year 1920–21. Dr. William M. Dehn, professor of chemistry, University of Washington and Dr. E. P. Lewis, professor of physics, University of California, were elected members of the executive committee to serve five years and Dr. E. C. Franklin, professor of chemistry, Stanford University, was elected a member of the executive committee to fill the vacancy caused by the election of Dr. Ritter to the presidency.

The officers of the Pacific Division for the coming year are accordingly as follows:

Dr. William E. Ritter, president, Scripps Institution for Biological Research, La Jolla, Calif.

Dr. Barton W. Evermann, vice-president and chairman of the executive committee, California Academy of Sciences, San Francisco, Calif.

W. W. Sargeant, secretary-treasurer, California Academy of Sciences, San Francisco, Calif.

MEMBERS OF THE EXECUTIVE COMMITTEE

Dr. Barton W. Evermann, chairman, California Academy of Sciences, San Francisco, Calif.

Dr. William E. Ritter, Scripps Institution for Biological Research, La Jolla, Calif.

Dr. W. W. Campbell, Lick Observatory, Mount Hamilton, Calif.

Dr. William M. Dehn, University of Washington, Seattle, Wash.

Dr. E. C. Franklin, Stanford University, Calif.

Dr. C. E. Grunsky, Mechanics Institute Building, San Francisco, Calif.

Dr. T. F. Hunt, University of California, Berkeley, Calif.

Dr. E. P. Lewis, University of California, Berkeley, Calif.

Dr. D. T. MacDougal, Desert Laboratory, Tucson, Arizona.

An amendment to the constitution of the Pacific Division was proposed in executive session held Thursday evening June 17 to exclude Arizona and the states of Chihuahua and Sonora in Mexico from the territory of the division. This action was in conformity with that taken by the National Council which has caused these states to be included in a recently organized division of the American Association.

As an encouraging sign that the purposes of the annual meeting are being in some measure fulfilled it is noted that considerable publicity was given to the meeting in the Seattle papers. At least two editorials appeared on topics related to the discussions and reports of the meetings were given in some detail. This would indicate that the public is becoming more generally interested in the progress of science and augurs well for the future support of scientific investigation.

Announcement was made by the executive committee that the next annual meeting would be held in the San Francisco Bay region, the definite time and place to be determined later. This location will accommodate the largest number of members and should insure a good attendance for the 1921 meeting.

W. W. Sargent,
Secretary

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